

Modelling transport fuels and future scenarios for the Danish energy system

Giada Venturini, PhD project

Background and current challenges

As a result of the increased awareness on the threat posed by climate change, the current research is heavily focusing on ways for implementing efficient and environmentally friendly energy systems. On the other hand, the transportation sector, accounting for about 20% of the energy use and related CO₂ emissions worldwide, has also progressively been subjected to analysis.

Energy system models, like TIMES-DK in Denmark, have been developed with the aim of evaluating future energy scenarios and assessing the impact of policy measures on the economic system. As the introduction of alternative fuels and innovative technologies in the transport sector represents a challenge for reaching the goal of a future 100% renewable energy system in Denmark, there is a current need for modelling the integrated transport and energy system.

Research questions

The PhD project will contribute to the research in this field by modelling emerging alternative fuel production technologies in TIMES-DK, thereby allowing for an integrated representation of the energy and transport system for Denmark. Supported by the developed model, the research will focus on future transport scenarios and policy analysis, with the aim of defining feasible and sustainable renewable energy (RE) pathways for 2050. The research study builds on the following research questions:

- How to identify and assess the feasibility of alternative fuel chains?
- Which are the plausible scenarios for the future transport system in Denmark?
- What is the impact of background systems and behavioural changes on the future transport system?
- Which are the policy measures that better support the transition to the desirable future transport and energy system?

Methodology

Data including costs, emission factors, efficiencies and system characteristics for emerging fuel production technologies will be collected from previous studies, technology catalogues and databases. Selected alternative fuel chains will be integrated in the optimization model TIMES-DK and the feasibility of the modelled transport system will be investigated. Furthermore, within a participatory framework with stakeholders, a set of plausible scenarios for the future Danish transport system will be developed and implemented in TIMES-DK, hereby quantifying the future transport demand, conversion potential to alternative fuels and transport technologies and resources availability. The study will conclude with the analysis of the policy measures needed to promote investments in transport, fuel and energy infrastructure, conversion to new technologies and vehicles, along with changes in human behaviour affecting transport and energy systems.

Expected results

The research project will provide an analysis of the feasibility of future scenarios for the Danish energy and transport system, along with the identification of robust and sustainable 100% RE pathways for 2050. Moreover the study will examine the required policy measures to achieve the desirable future transport and energy system for Denmark.



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